



PATENT DOCKET NO. 28207.3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Robert Bruce Wakelam, et al.

Serial No.: 09/518,697

Filed: March 3, 2000

For: COMPUTER-IMPLEMENTED
AUTOMATED BUILDING DESIGN
AND MODELING AND COST
ESTIMATION AND SCHEDULING
SYSTEM

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Art Unit: 2763

Examiner: Unknown

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LETTER TO THE OFFICIAL DRAFTSPERSON

Commissioner For Patents
Washington, D.C. 20321

Dear Sir:

Enclosed are **thirty-eight (38)** sheets of formal drawings in connection with the above-identified patent application. Applicants respectfully request approval.

Respectfully submitted,



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D-813554.1

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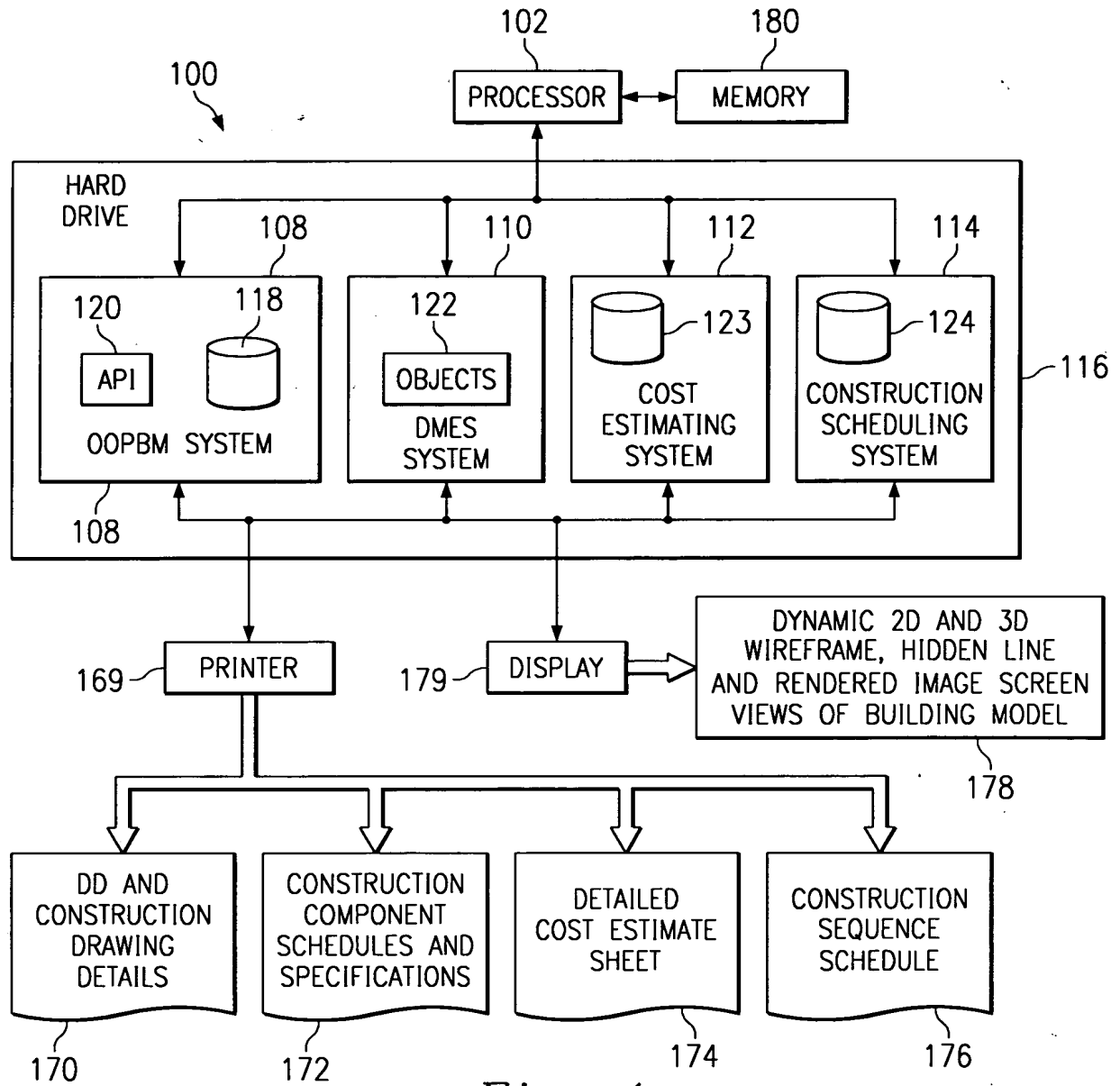


Fig. 1

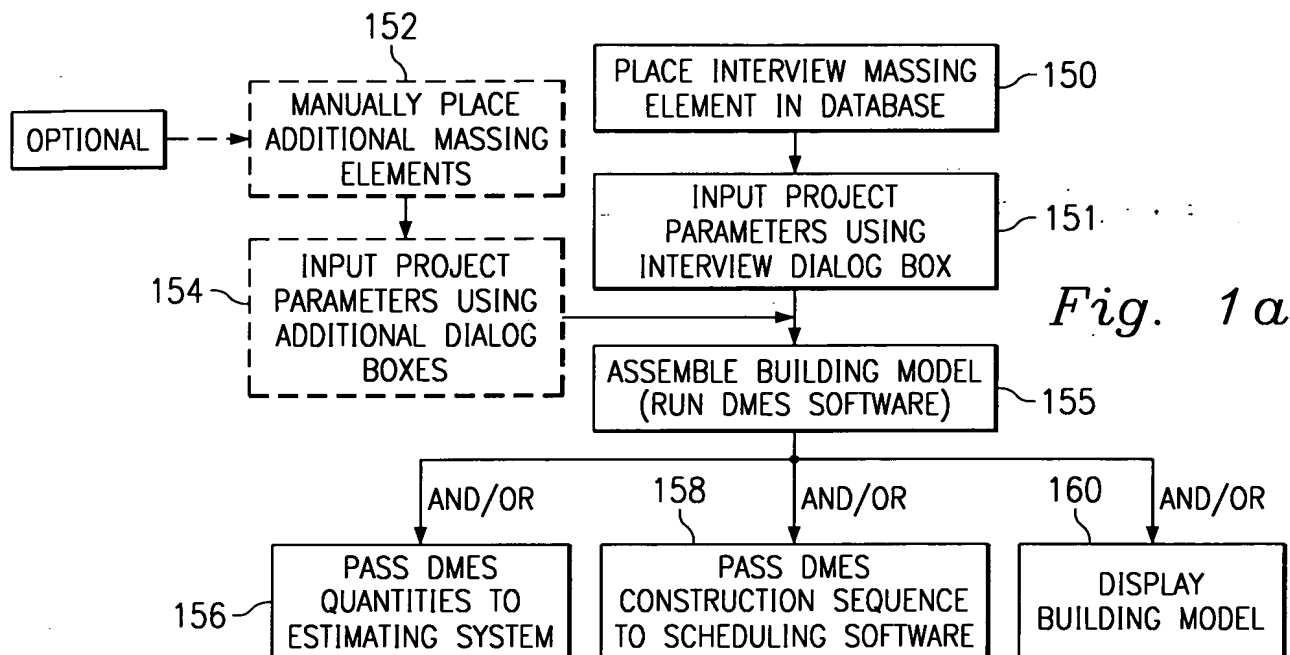
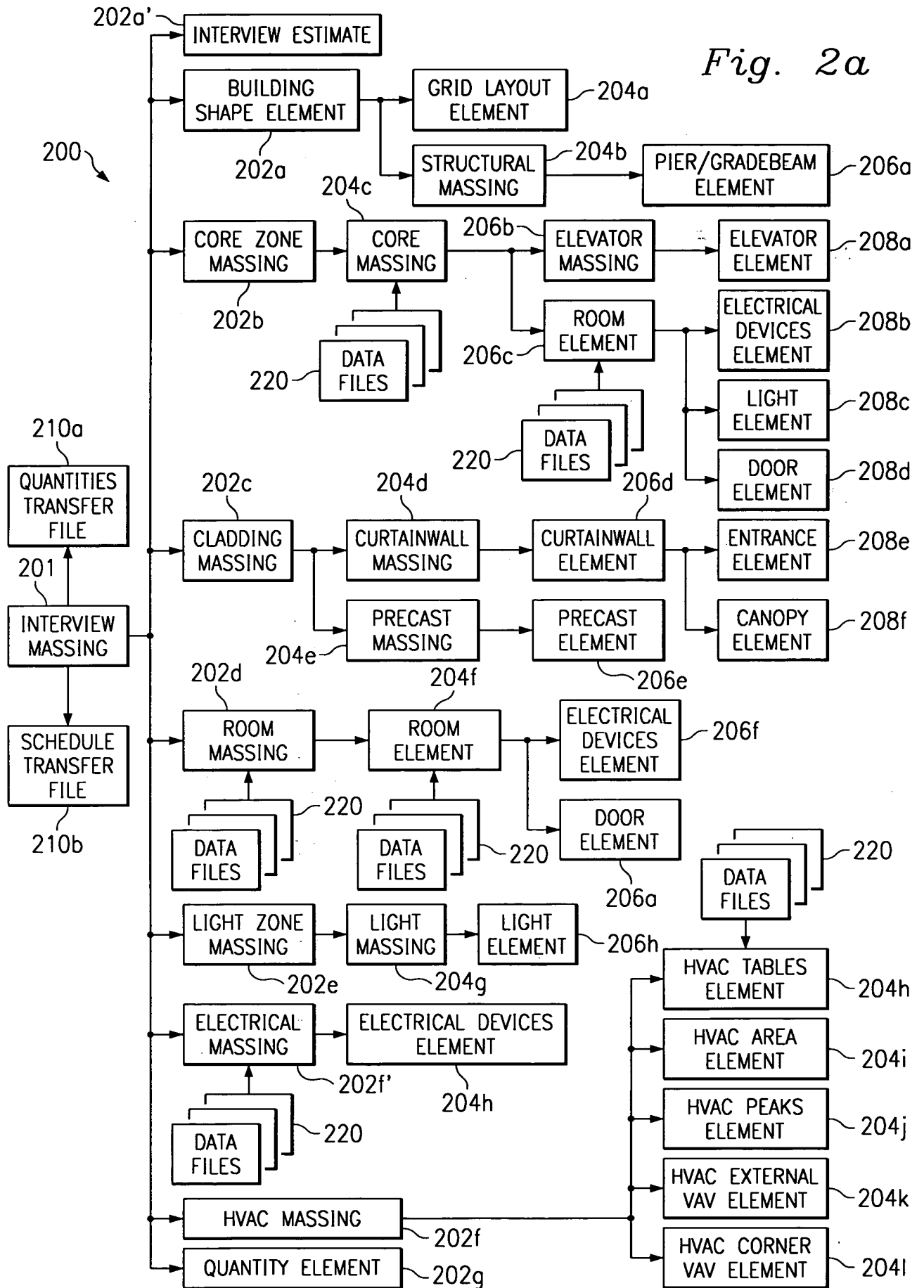


Fig. 1a

Interview									
Building Floor Area		22256		City		Tx, Dallas			
Number of Floors		1		SF per Person		200			
Building Shape		Rectangle							
Info	Building	Site	Structure	Cladding	Lighting	HVAC	Tasks	T	
Customer Name		Customer							
Project Name		Project							
Date		Date							
Estimate #		01							
CATEGORY		PERCENTAGE							
General Conditions		8							
Contingency		0							
Fee		5							
OK		Apply		Cancel		Help			

Fig. 1b

Fig. 2a



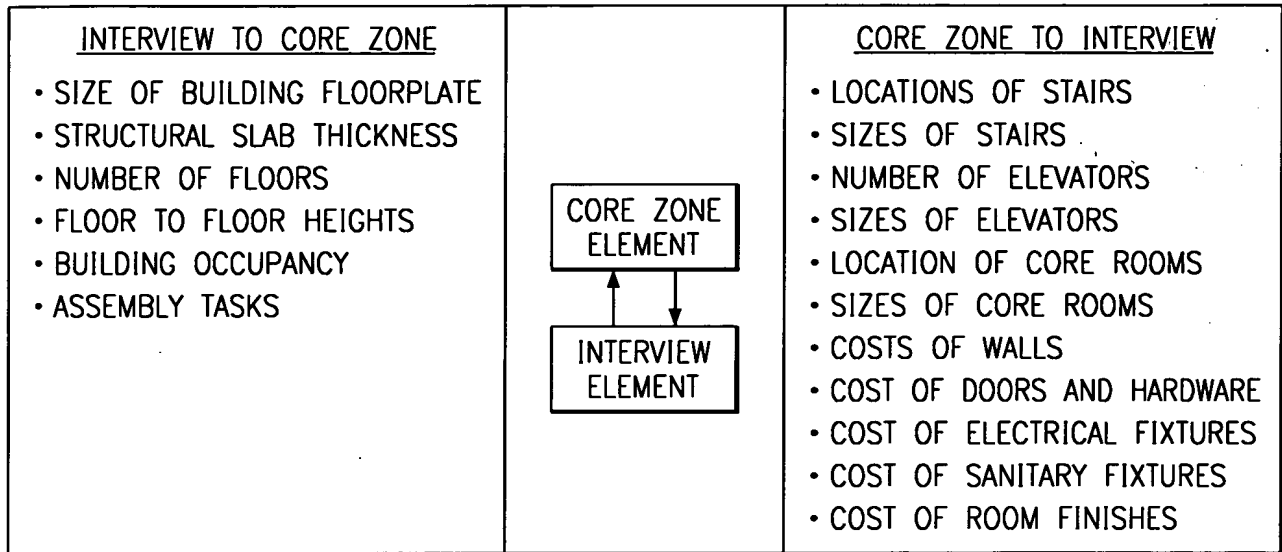


Fig. 2b

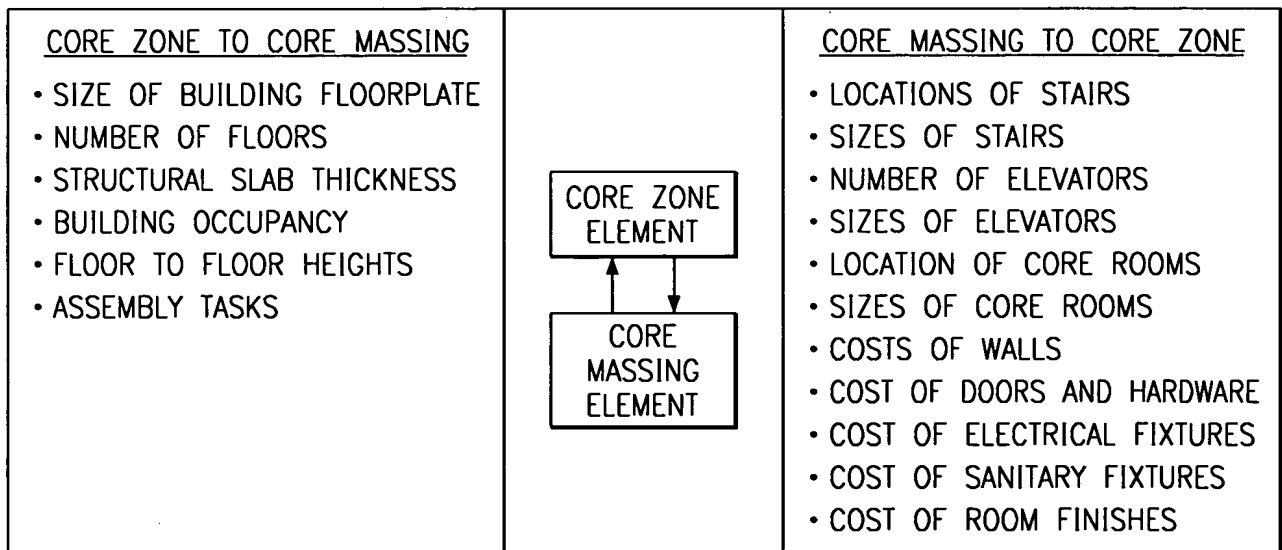


Fig. 2c

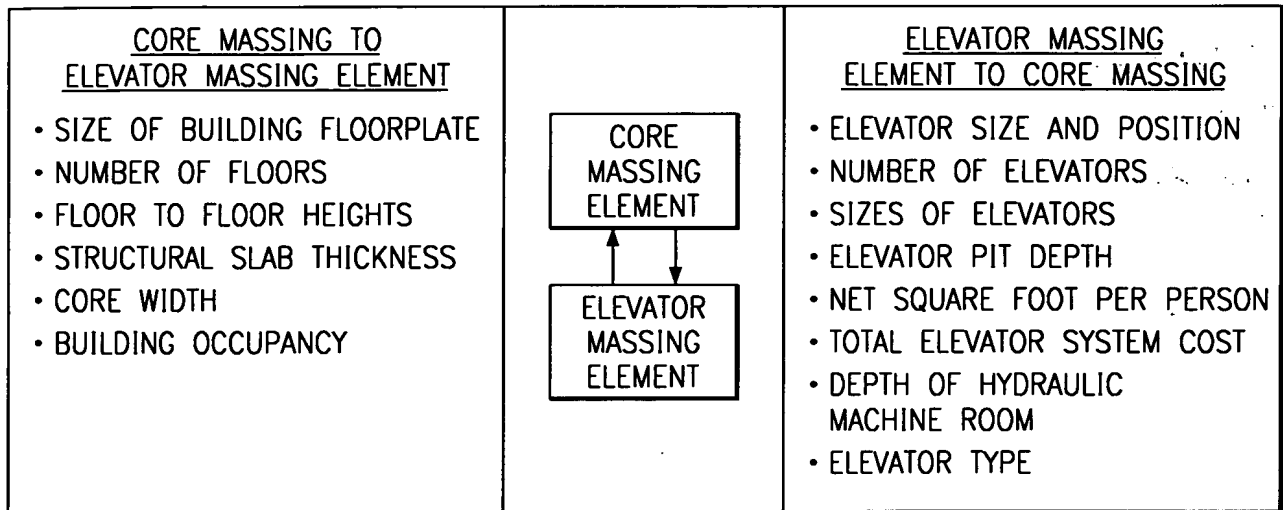


Fig. 2d

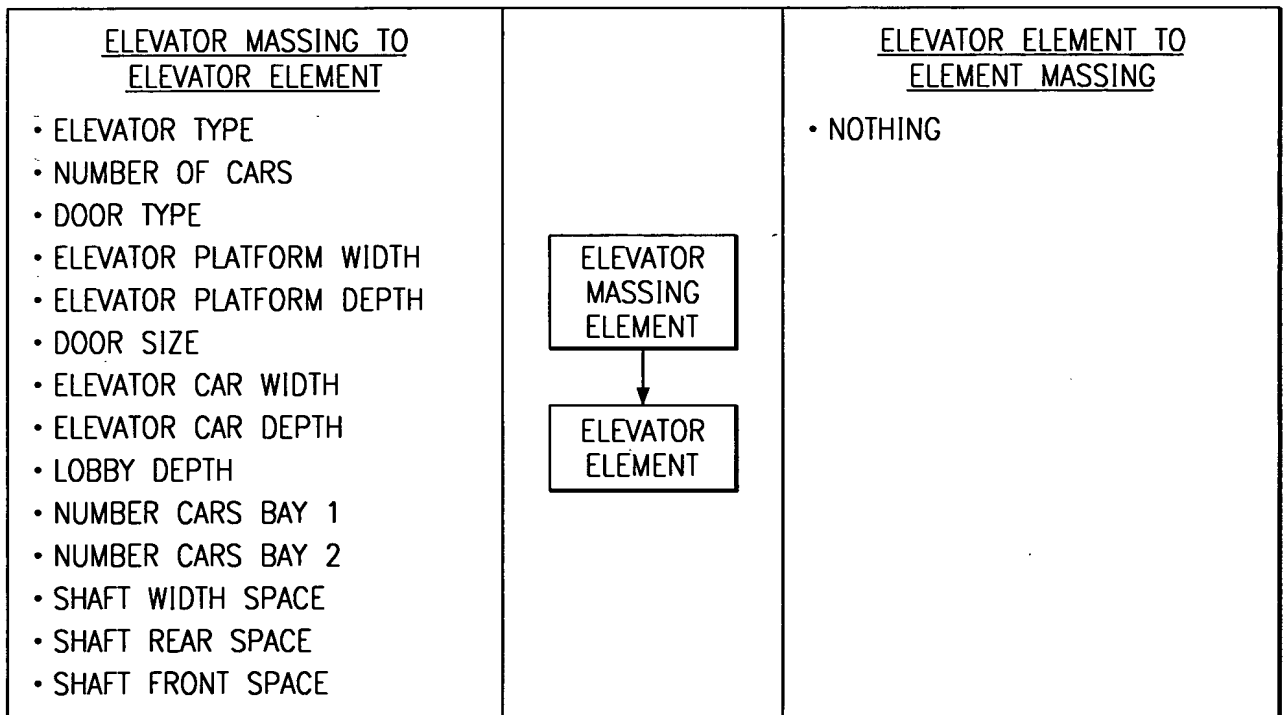
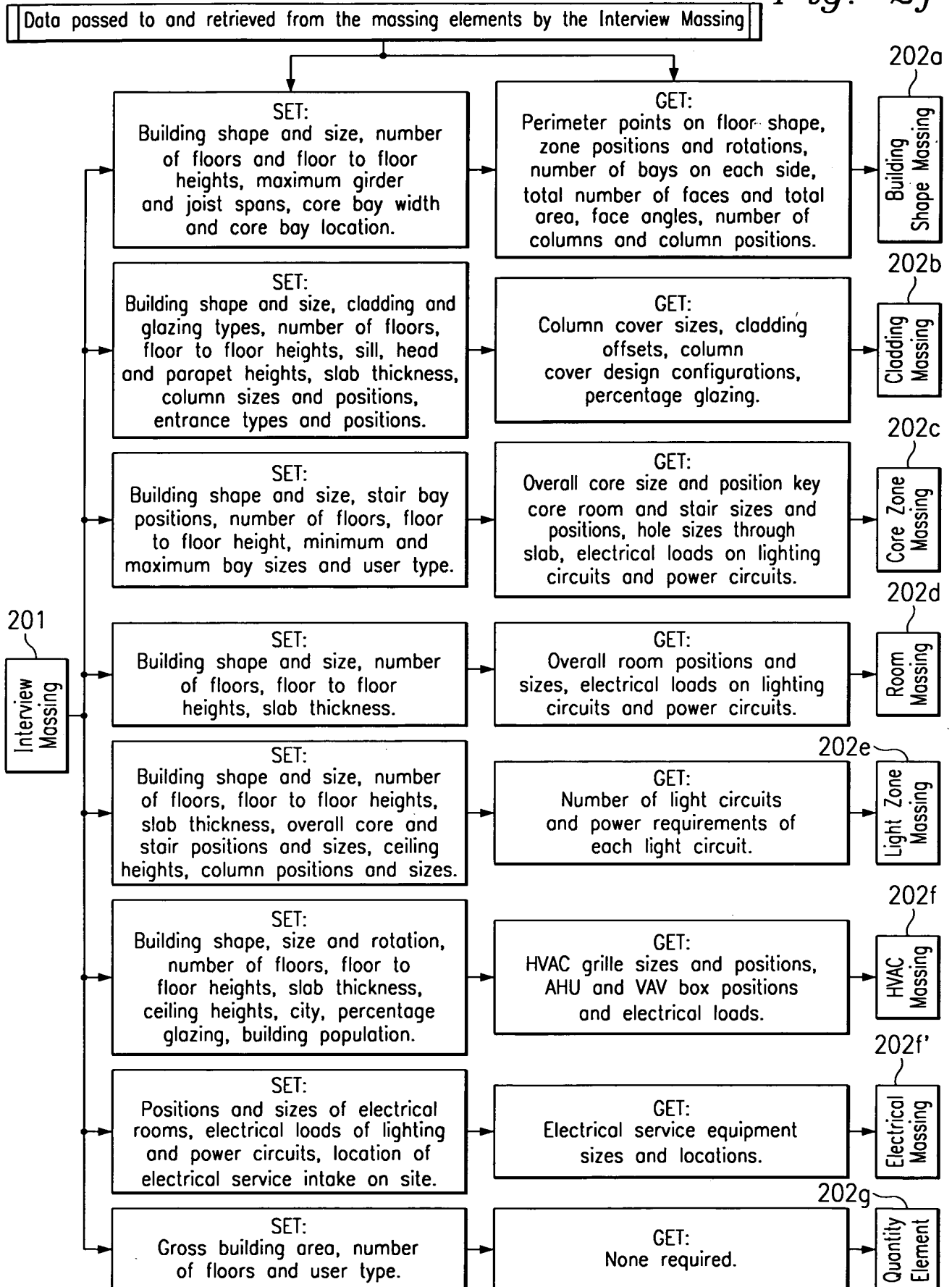


Fig. 2e

Fig. 2f



Interview Massing	Allows input of design requirements from customer and initiates automatic assembly of building model by placing instances of the next tier of massing elements in the hierarchy and passing them appropriate design parameters. This massing element also places an instance of the interview estimate element, which is automatically passed quantity data directly from each of the elements in the hierarchy.
Interview Estimate	Placed by the interview-massing element, this element is automatically passed quantity data by the other elements in the hierarchy when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data.
Cladding Massing	Placed by the interview-massing element, this element is automatically passed the building parameters and the requirements for the cladding. It then assembles the appropriate cladding types on each part of each elevation of the building model by placing the curtainwall massing and precast massing elements as required.
Curtainwall Massing	Calculates the curtainwall cladding and glazing requirements for the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the curtainwall cladding and windows around the building by placing consecutive instances of the curtainwall element and the parapet, entrance and canopy elements.
Curtainwall Element	Designs the individual curtainwall or glazing panel from design parameters passed to it by the curtainwall-massing element. This element also calculates an accurate set of quantities for materials and components used to assemble the panel. The element can also place instances of the entrance and canopy elements when required, and pass them appropriate design parameters.
Parapet Element	Designs the individual roof parapet sections from design parameters passed to it by the curtainwall-massing element. This element also calculates an accurate set of quantities for materials and components used to assemble the parapet section.
Entrance Element	Designs the individual entrance doors and panels from design parameters passed to it by the curtainwall element. This element also calculates an accurate set of quantities for materials and components used to assemble the entrance.
Canopy Element	Designs the individual canopies over the main entrances from design parameters passed to it by the curtainwall element. This element also calculates an accurate set of quantities for materials and components used to assemble the canopy.
Curtainwall Estimate	Placed by the curtainwall-massing element, this element is automatically passed quantity data by the curtainwall elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the curtainwall cladding and glazing.

Fig. 2g

Precast Massing	Calculates the precast cladding requirements for the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the precast panels around the building by placing consecutive instances of the precast element.
Precast Element	Designs the individual precast panel from design parameters passed to it by the precast-massing element. This element also calculates an accurate set of quantities for materials, components and labor used to assemble the panel.
Precast Estimate	Placed by the precast-massing element, this element is automatically passed quantity data by the precast elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the precast cladding.
Core Zones Massing	Placed by the interview-massing element, this element is automatically passed the building parameters and the requirements for the various core layouts. It then assembles the appropriate core layouts into each zone on each floor of the building model by placing the core massing element as required.
Core Massing	Calculates the core requirements for the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the rooms in the core of the building by placing the elevator massing element and consecutive instances of the room element.
Room Massing	Calculates the room requirements for the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the rooms on each floor of the building by placing consecutive instances of the room element.
Room Element	Calculates the requirements for each room from the room parameters passed to it by the core-massing or room-massing elements and design data read in from external room data files. This element then assembles the contents of the room in by placing instances of the lighting, electrical devices and furniture elements.
Stair Element	This element calculates the floor to floor stair requirements from data sent to it by the room element and sizes itself to fit the building.
Grouping Massing	This element assembles a group of instances in the appropriate locations from data read in from external data files. This element is typically placed by the room element to control the grouping of the contents of the room.
Door Element	This element calculates the opening requirements from data sent to it by the room element and sizes itself to fit the door opening.

Fig. 2h

Room Estimate	Placed by the core-massing or room-massing elements, this element is automatically passed quantity data by the room elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the rooms.
Elevator Massing	Calculates the elevating requirements for the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the elevators on each floor of the building by placing consecutive instances of the elevator typical element and the elevator roof element.
Elevator Typical Element	This element calculates the typical floor to floor elevator requirements from data sent to it by the elevator massing element and sizes itself accordingly.
Elevator Roof Element	This element calculates the roof level elevator requirements from data sent to it by the elevator massing element and sizes itself accordingly.
Elevator Estimate	Placed by the elevator-massing element, this element is automatically passed quantity data by the elevator elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the elevators.
Light Massing	Calculates the lighting requirements for each floor of the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the lights on each floor of the building by placing consecutive instances of the light element. Potential clashes between lights and other building components are automatically handled by functionality in this element checking the positioning of these elements and repositioning each light.
Light Element	Configures its self as the appropriate light fixture dependent on data passed to it by the light massing element. This element also routes its own circuit wiring to connect it to its neighbor in the circuit or to the light switch or appropriate junction box. It then calculates the types and quantities of wire and insulation used.
Lighting Estimate	Placed by the light-massing element, this element is automatically passed quantity data by the light elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the lights and wiring.
Building Shape Element	Determines the building configuration and floor plate area. Allows adjustment of various variables that make up the building perimeter. Calculates the perimeter points and sends this information to the grid/dimension element to calculate the grid layout then the structure element is called to calculate the structural components and estimate.

Fig. 2i

Grid/ Dimension Element	Calculates the grid layout dimensions for the building configuration.
Structure Element	Receives the building layout and grid locations from above elements then calculates all pier, column, beam and joist locations. Accumulates all quantities and develops an estimate for the structure.
Pier Cap/ Grade Beam Element	Calculates the location and sizes for the pier caps and grade beams.
Electrical Massing	Calculates the electrical service requirements for each floor of the building from the parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles electrical service equipment and wiring on each floor of the building by placing consecutive instances of the electrical device element. It can also generate a graphical spreadsheet in the database, which displays the high and low voltage electrical service panel circuit breaker diagrams.
Electrical Device Element	Configures its self as the appropriate electrical equipment or device dependent on data passed to it by the electrical massing element. This element also routes its own circuit wiring to connect it to its neighbor in the circuit or to the appropriate junction box. It then calculates the types and quantities of wire and insulation used.
Electrical Estimate	Placed by the electrical-massing element, this element is automatically passed quantity data by the electrical device elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the electrical devices, equipment and wiring.
HVAC Massing	Receives the building configuration from the building shape element then calls the HVAC Area element to calculate all zone areas. Then passes these areas to the peaks element which calls the tables element and the floor and building peak loads are calculated. This element then places instances of the exterior, interior and corner VAV elements, which calculate the VAV box and Duct sizes.
HVAC Exterior VAV Element	Calculates the exterior VAV box, duct and diffuser sizes for the perimeter zones.

Fig. 2j

HVAC Interior VAV Element	Calculates the interior VAV box, duct and diffuser sizes.
HVAC Corner VAV Element	Calculates the corner VAV box, duct and diffuser sizes for the perimeter zones.
HVAC Area Element	Receives the building perimeters from the HVAC massing element, breaks the building up into interior, exterior and corner zones then calculates the floor square footage for each zone.
HVAC Peaks Element	Receives the ASHRAE cooling and heating load tables from the tables element and the zone areas from the area element and calculates the building and floor peak load design criteria.
HVAC Tables Element	Receives the longitude, latitude and other pertinent information about the building location and creates cooling load, solar gain and factor tables to be used to calculate the design building loads.
HVAC Estimate	Placed by the HVAC-massing element, this element is automatically passed quantity data by the HVAC elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the HVAC system.
Site Massing	Calculates the site requirements for the building from the building parameters passed to it by the interview-massing element and design data read in from external data files. This element then assembles the site layout around the building by placing applicable instances of the site element.
Site Element	Designs the individual site elements from design parameters passed to it by the site-massing element. This element also calculates an accurate set of quantities for materials and components used to assemble the site layout.
Site Estimate	Placed by the site-massing element, this element is automatically passed quantity data by site elements when they are executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the site layout.
Quantities Element	Placed by the interview-massing element, this element calculates additional required building components not covered by the individual estimate elements listed above. Applicable building information is passed by the interview-massing element when it is executed. It then generates a graphical spreadsheet in the database, which displays the cost estimate data for the additional building components. It also passes its quantity data directly to the interview estimate element.

Fig. 2k

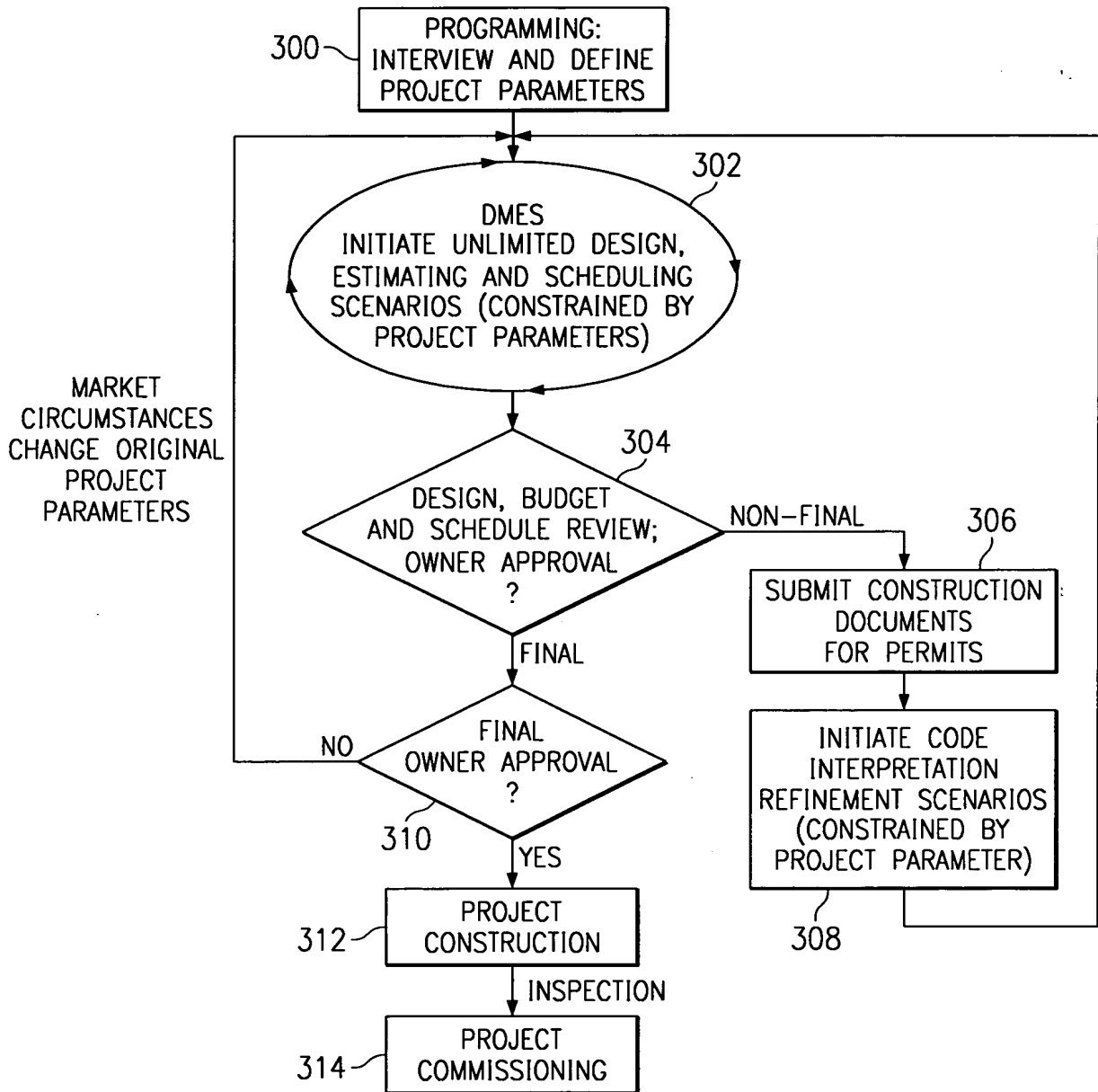


Fig. 3

402

Fig. 4a

Building Shape and Grid Layout

☐ Change Structure Coordinates/Bays

Modify Zone #

Info Modify Points Perimeter

Floor Plate Area

Number Of Floors

Building Rotation

Girder Direction (N/S or E/W)

Grider Max Span

Joist Max Span

Cladding Max Span

---Variables Along X-Axis---

Core Bay Location

Core Bay Width

Offset Columns

---Variables Along Y-Axis---

Core Bay Location

Core Bay Width

Offset Columns

▼

☐ Show Grids Only

☒ Show Dimensions

☐ Return to Default Values

☒ Get Cladding Bay Lengths

☐ Show estimate

☒ Assemble

☐ Show Griders_Columns

☐ Columns Only

Save as Building Number

Reconstruct Building Number

OK Apply Cancel Help

404

Fig. 4b

Building Shape and Grid Layout

☐ Change Structure Coordinates/Bays

Modify Zone #

Number of Zones

Zone Rotation

☒ Perimeter Columns

X-AXIS DIMENSIONS

Column Width

Number of Bays

Freeze Bay (Number, Length) ☐ Unfreeze

Y-AXIS DIMENSIONS

Column Width

Number of Bays

Freeze Bay (Number, Length) ☐ Unfreeze

☐ Dimension Lines Top

☒ Dimension Lines Right

☒ Calc Min. Number Bays

☐ Undo Last Change

406

Fig. 4c

Building Shape and Grid Layout

☐ Change Structure Coordinates/Bays

Modify Zone #

Info Modify Points Perimeter

Point 1 (X,Y)	<input type="text" value="0,0"/>
Point 2 (X,Y)	<input type="text" value="210,0"/>
Point 3 (X,Y)	<input type="text" value="210,80"/>
Point 4 (X,Y)	<input type="text" value="180,105"/>
Point 5 (X,Y)	<input type="text" value="180,120"/>
Point 6 (X,Y)	<input type="text" value="-30,120"/>
Point 7 (X,Y)	<input type="text" value="-30,40"/>
Point 8 (X,Y)	<input type="text" value="0,15"/>
Point 9 (X,Y)	<input type="text" value="0,0"/>
Point 10 (X,Y)	<input type="text"/>
Point 11 (X,Y)	<input type="text"/>
Point 12 (X,Y)	<input type="text"/>
Point 13 (X,Y)	<input type="text"/>
Point 14 (X,Y)	<input type="text"/>
Point 15 (X,Y)	<input type="text"/>
Point 16 (X,Y)	<input type="text"/>
Point 17 (X,Y)	<input type="text"/>
Point 18 (X,Y)	<input type="text"/>
Point 19 (X,Y)	<input type="text"/>
Point 20 (X,Y)	<input type="text"/>
Start Point X, Y	<input type="text" value="30,0"/>

OK Apply Cancel Help

408

Fig. 4d

Building Shape and Grid Layout

☐ Change Structure Coordinates/Bays

Modify Zone #

Info	Modify	Points	Perimeter
Point 1 (X,Y)		<input type="text" value="0,0"/>	
Point 2 (X,Y)		<input type="text" value="0,1"/>	
Point 3 (X,Y)		<input type="text" value="0,2"/>	
Point 4 (X,Y)		<input type="text" value="0,3"/>	
Point 5 (X,Y)		<input type="text" value="0,4"/>	
Point 6 (X,Y)		<input type="text" value="1,1"/>	
Point 7 (X,Y)		<input type="text" value="1,2"/>	
Point 8 (X,Y)		<input type="text" value="2,1"/>	
Point 9 (X,Y)		<input type="text" value="2,2"/>	
Point 10 (X,Y)		<input type="text" value="2,3"/>	
Point 11 (X,Y)		<input type="text" value="2,4"/>	
Point 12 (X,Y)		<input type="text" value="2,5"/>	
Point 13 (X,Y)		<input type="text" value="2,6"/>	
Point 14 (X,Y)		<input type="text" value="2,7"/>	
Point 15 (X,Y)		<input type="text" value="0,6"/>	
Point 16 (X,Y)		<input type="text" value="0,7"/>	
Point 17 (X,Y)		<input type="text" value="0,8"/>	
Point 18 (X,Y)		<input type="text"/>	
Point 19 (X,Y)		<input type="text"/>	
Point 20 (X,Y)		<input type="text"/>	
Point 21 (X,Y)		<input type="text"/>	
Point 22 (X,Y)		<input type="text"/>	
Point 23 (X,Y)		<input type="text"/>	
Point 24 (X,Y)		<input type="text"/>	
Point 25 (X,Y)		<input type="text"/>	
Point 26 (X,Y)		<input type="text"/>	

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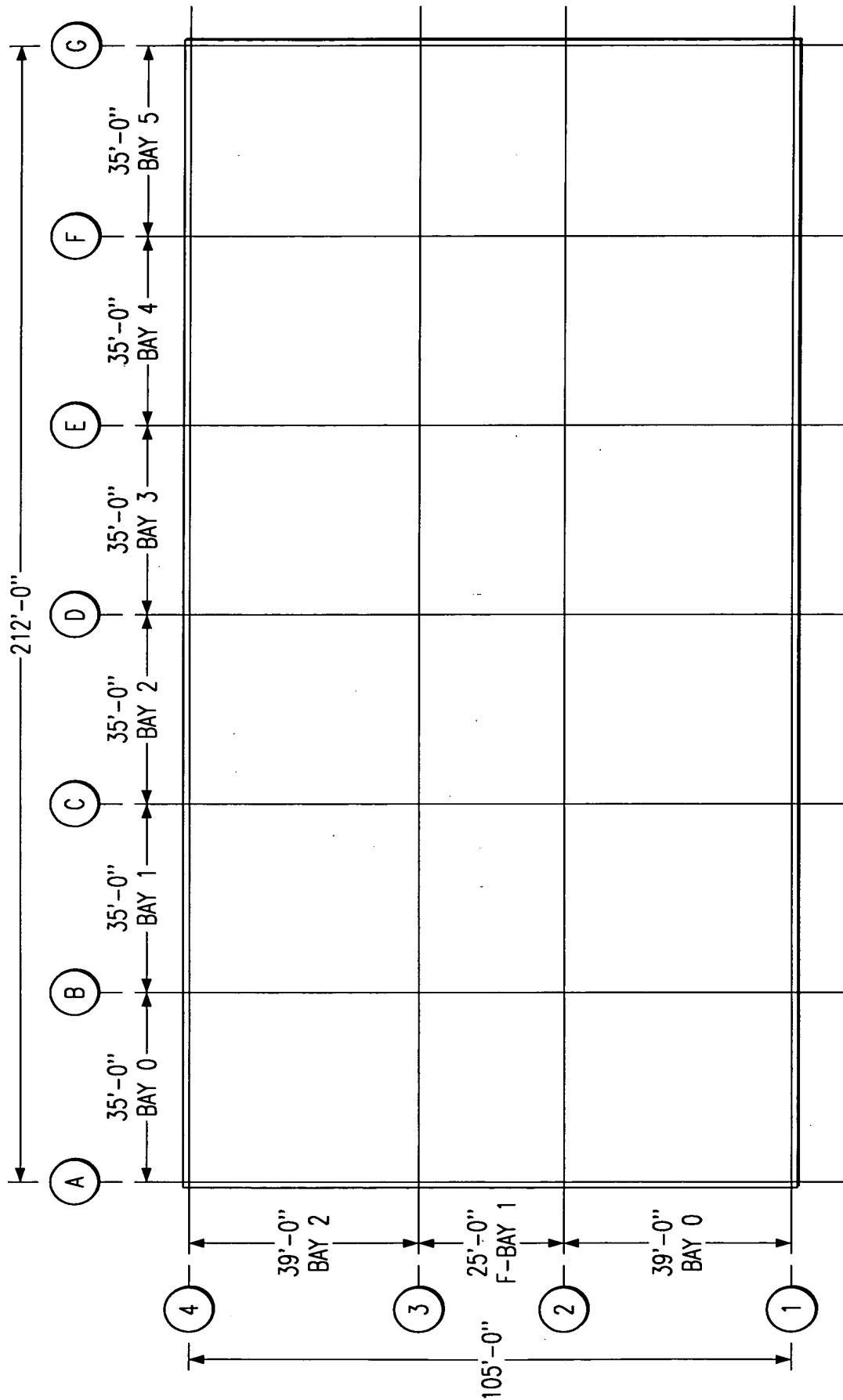


Fig. 4e

420

Fig. 4f

Structure

☐ Change Structure Coordinates/Bays

Info Modify Structure Openings

Area per floor	22000
Number of Floors	2
Height of Floor 1	18'0"
Typical Floor Height	13'6"
Joist Width	8"
Max Pan Width	5'6"
Slab Thickness	4-3/4"
Pan Depth	1'8"
Rotation	0
Skin Module	5'0"
Live Load	50
Partition Load	20
Skin Load	700

Building Shape

Rectangle ▼

<input type="checkbox"/> N/S Dimension	<input type="checkbox"/> E/W Dimension
<input type="checkbox"/> Get Precast Information	<input type="checkbox"/> Show Estimate
<input checked="" type="checkbox"/> Show Joist Location	<input type="checkbox"/> Show 3d Joist
<input type="checkbox"/> Show Dimensions	<input checked="" type="checkbox"/> Show Grids Only

OK Apply Cancel Help

422

Fig. 4g

Structure

☐ Change Structure Coordinates/Bays

Info

Modify

Structure

Openings

Zone Number

0

Girder Max Span

42'0"

Joist Max Span

35'0"

Minimum Bay Width

20'0"

Interior Beam Width

1'0"

Offset Columns

1'0"

---X_Axis Changes---

Number of Bays

6

☐ Accept

Core Bay Number X-Axis

Core Bay Width X-Axis

20'0"

Adjust Bay Number

Length

1

30'0"

4

20'0"

6

10'0"

---Y_Axis Changes---

Number of Bays

3

☐ Accept

Core Bay Number Y-Axis

Core Bay Width Y-Axis

20'0"

Adjust Bay Number

Length

2

22'0"

0"

0"

☒ Accept Above Changes

OK

Apply

Cancel

Help

424

Fig. 4h

Structure

☐ Change Structure Coordinates/Bays

Info

Modify

Structure

Openings

	X coord	Y coord
Point 1	0"	0"
Point 2	210'0"	0"
Point 3	210'0"	80'0"
Point 4	180'0"	105'0"
Point 5	180'0"	120'0"
Point 6	-30'0"	120'0"
Point 7	-30'0"	40'0"
Point 8	0"	15'0"
Point 9	0"	0"
Point 10	0"	0"
Point 11	0"	0"
Point 12	0"	0"
Point 13	0"	0"
Point 14	0"	0"
Point 15	0"	0"

Move Point #1

X =

Y =

0"

0"

OK

Apply

Cancel

Help

426

Fig. 4i

Structure

☐ Change Structure Coordinates/Bays

Info Modify Structure Openings

Zone Number	0
Opening Number	1
Lower Left Xvalue	5'0"
Lower Left Yvalue	30'0"
Opening Width	20'0"
Opening Height	10'0"
Opening Number	2
Lower Left Xvalue	35'0"
Lower Left Yvalue	60'0"
Opening Width	20'0"
Opening Height	10'0"

☐ Accept

☐ Zero all Openings

OK Apply Cancel Help

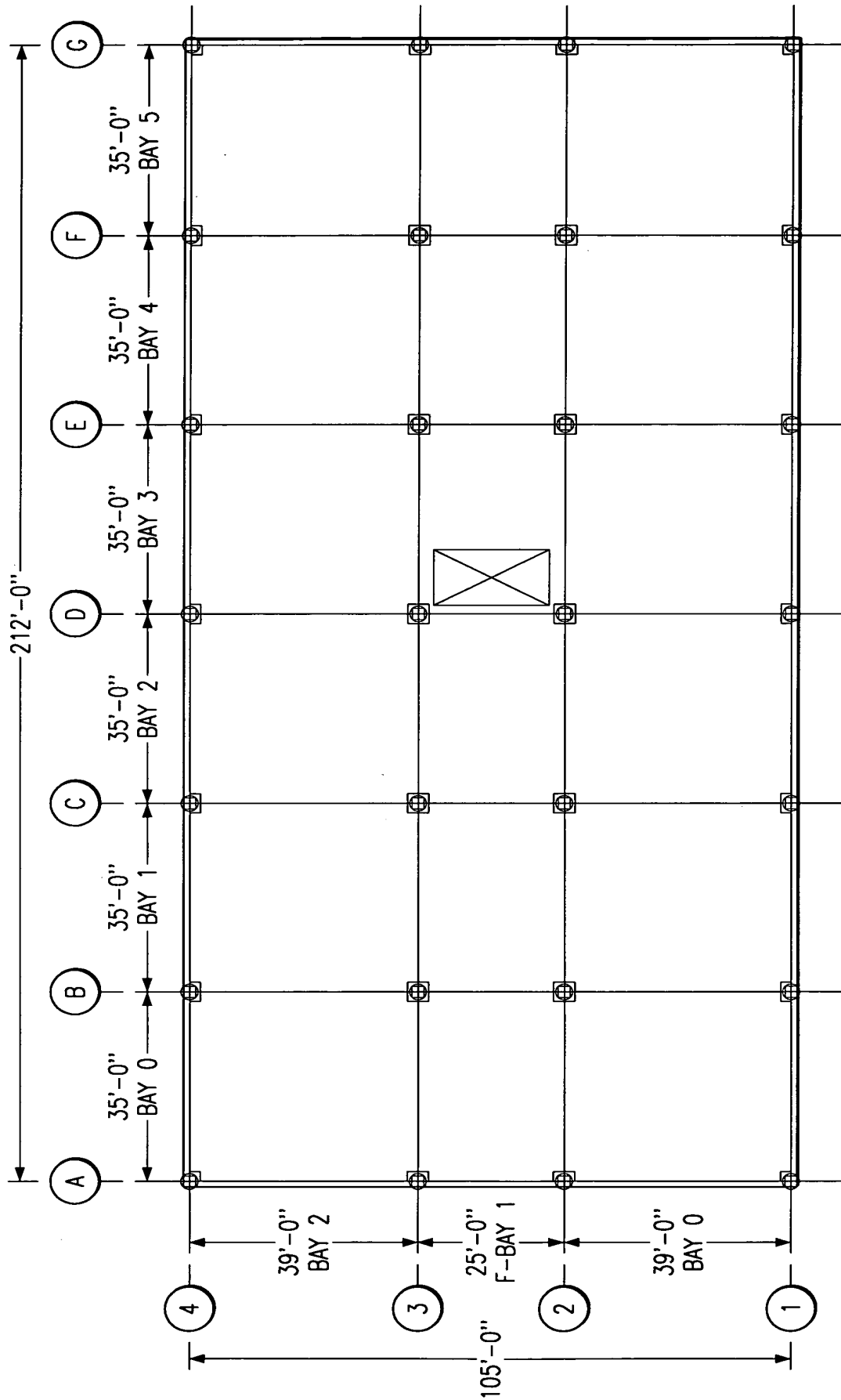


Fig. 4j

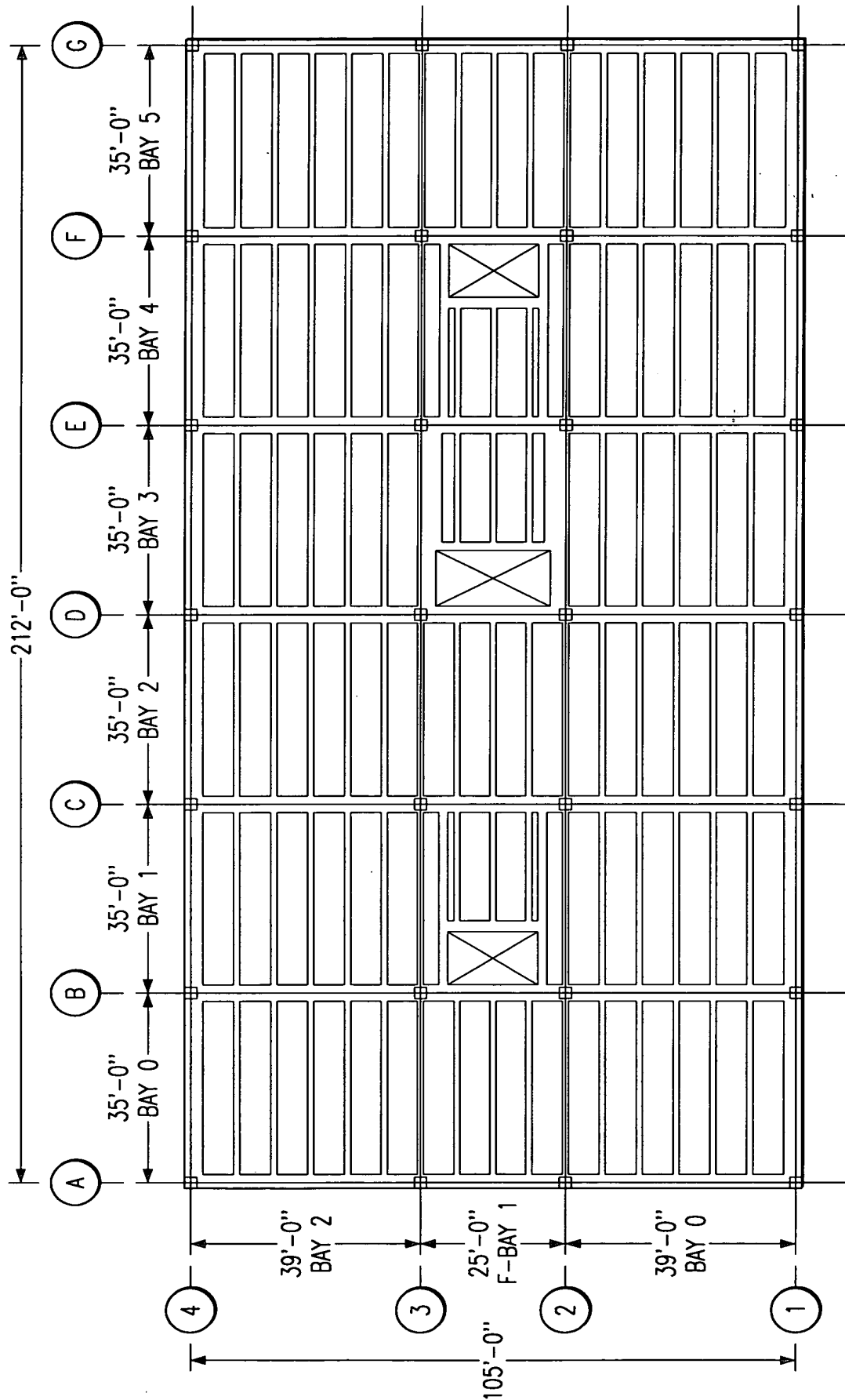


Fig. 4k

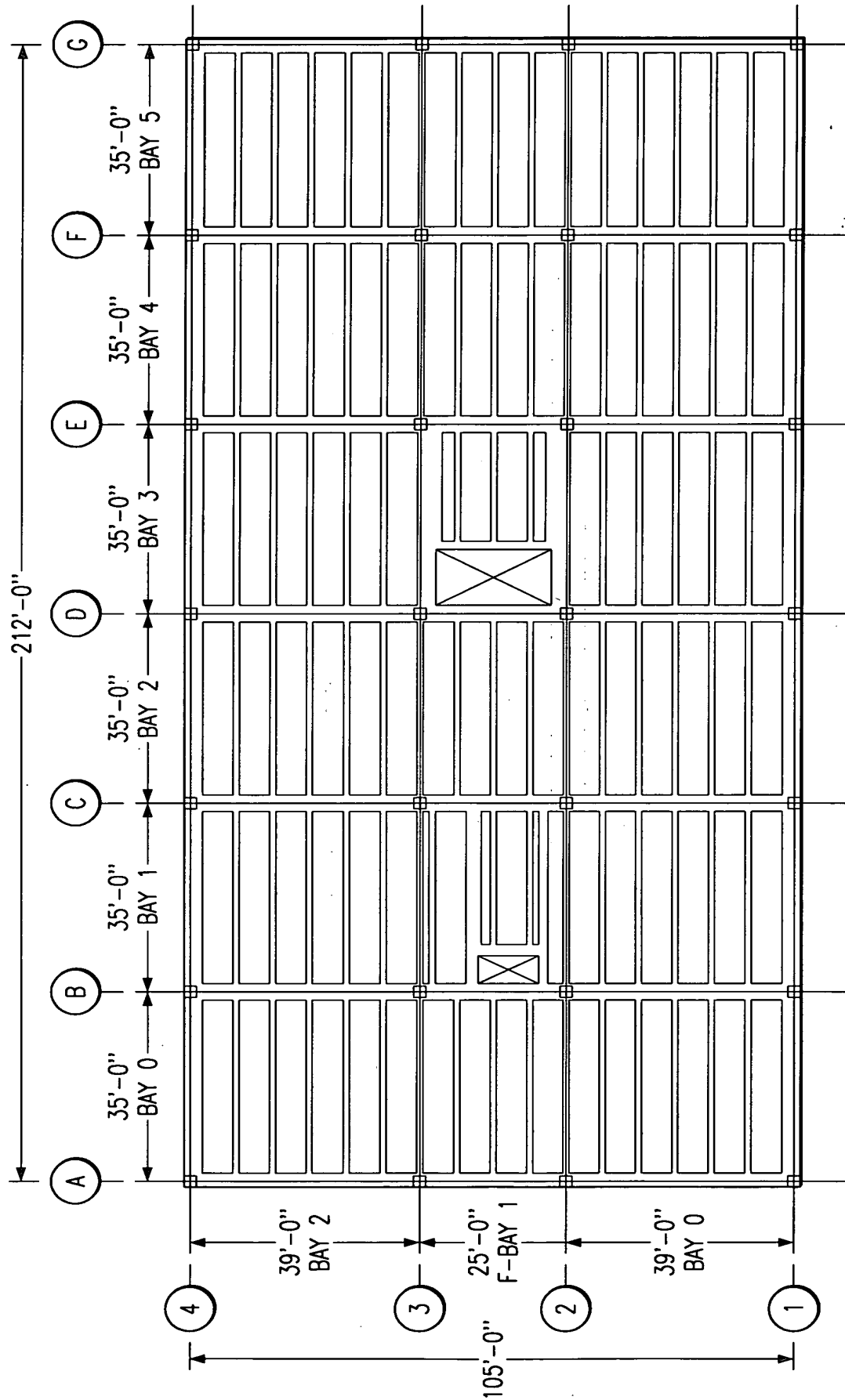


Fig. 4l

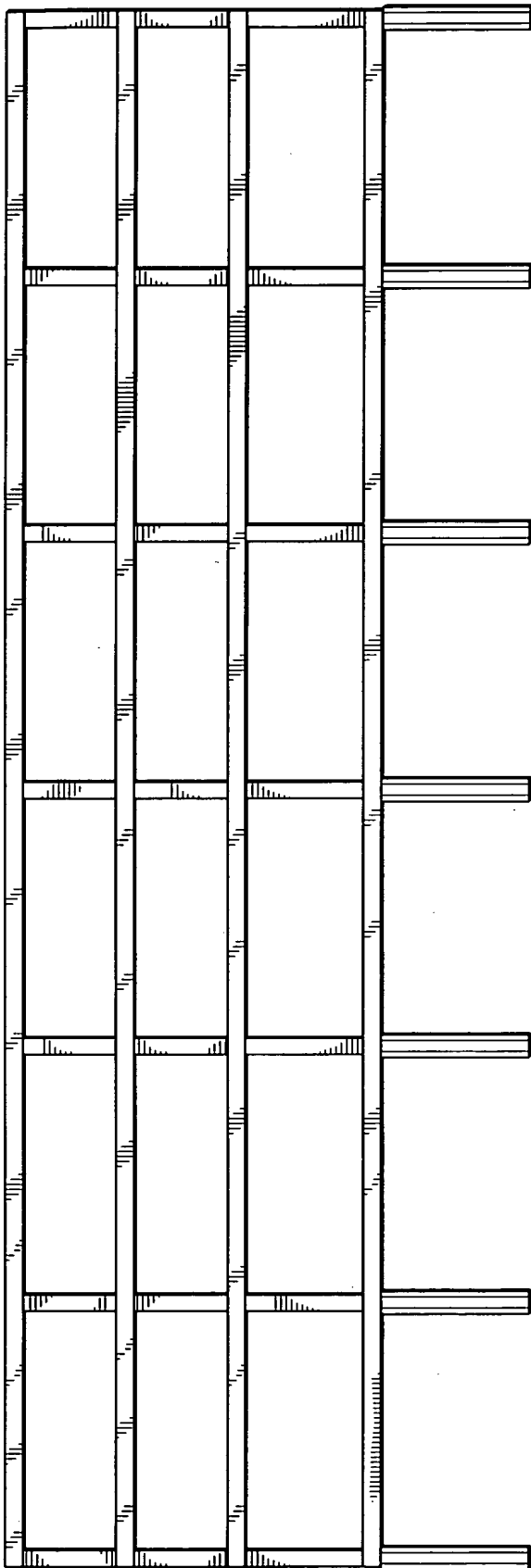


Fig. 4m

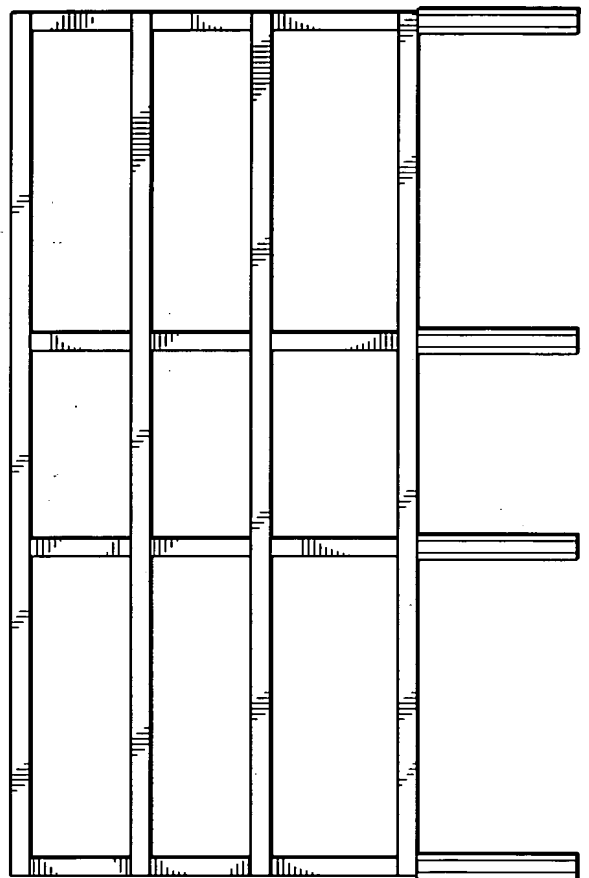
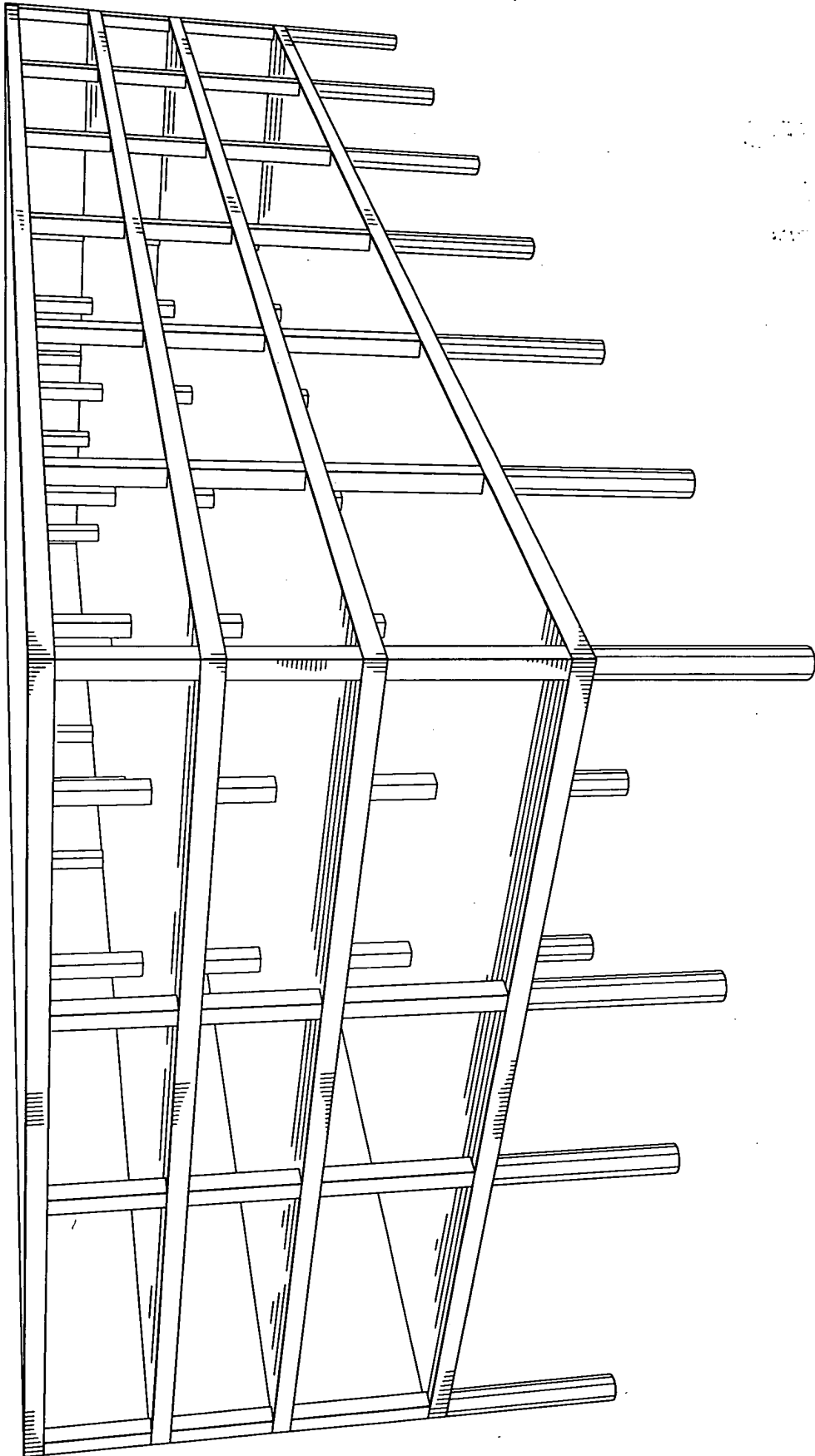


Fig. 4n

Fig. 40



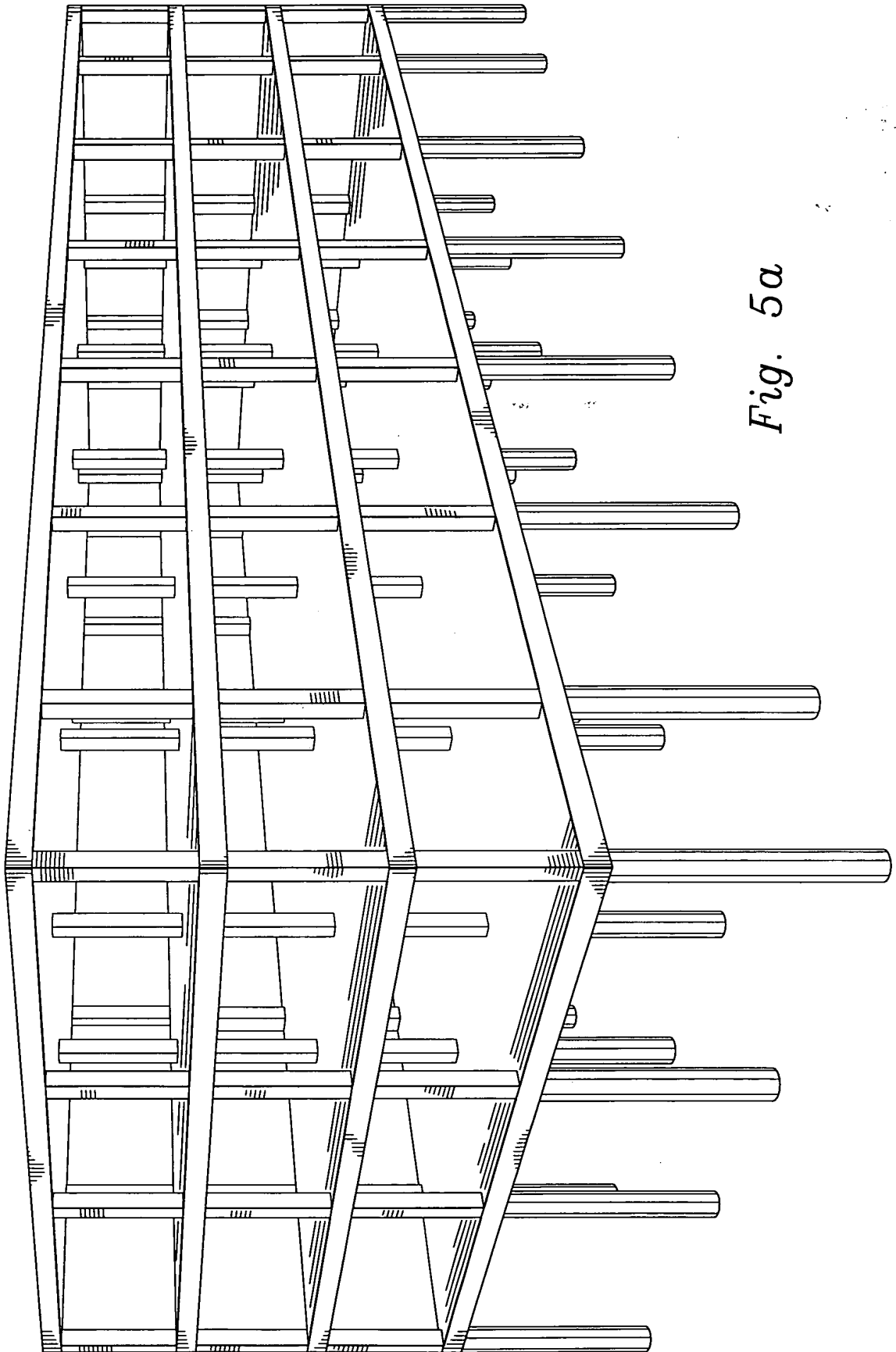


Fig. 5a

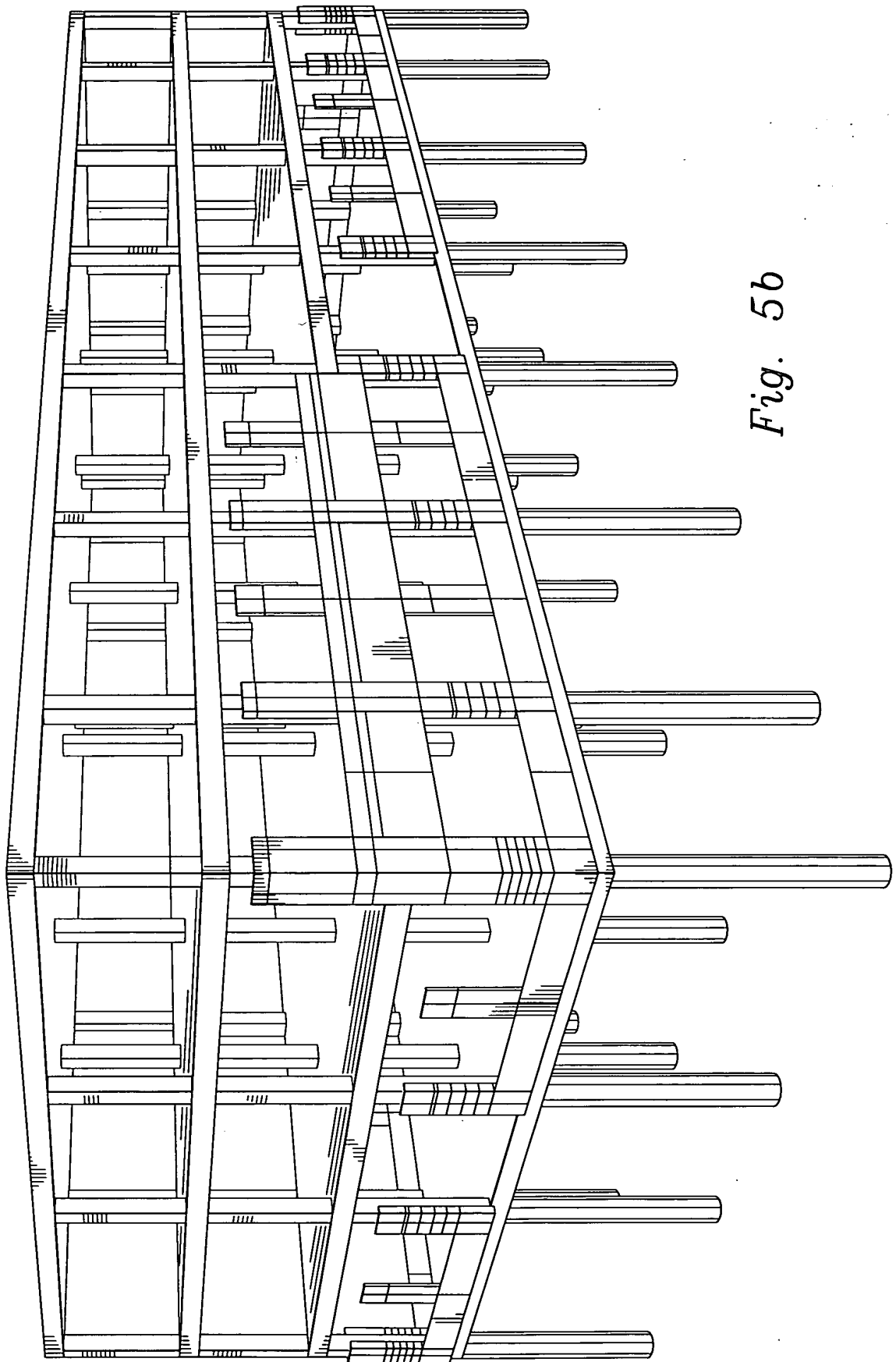


Fig. 5b

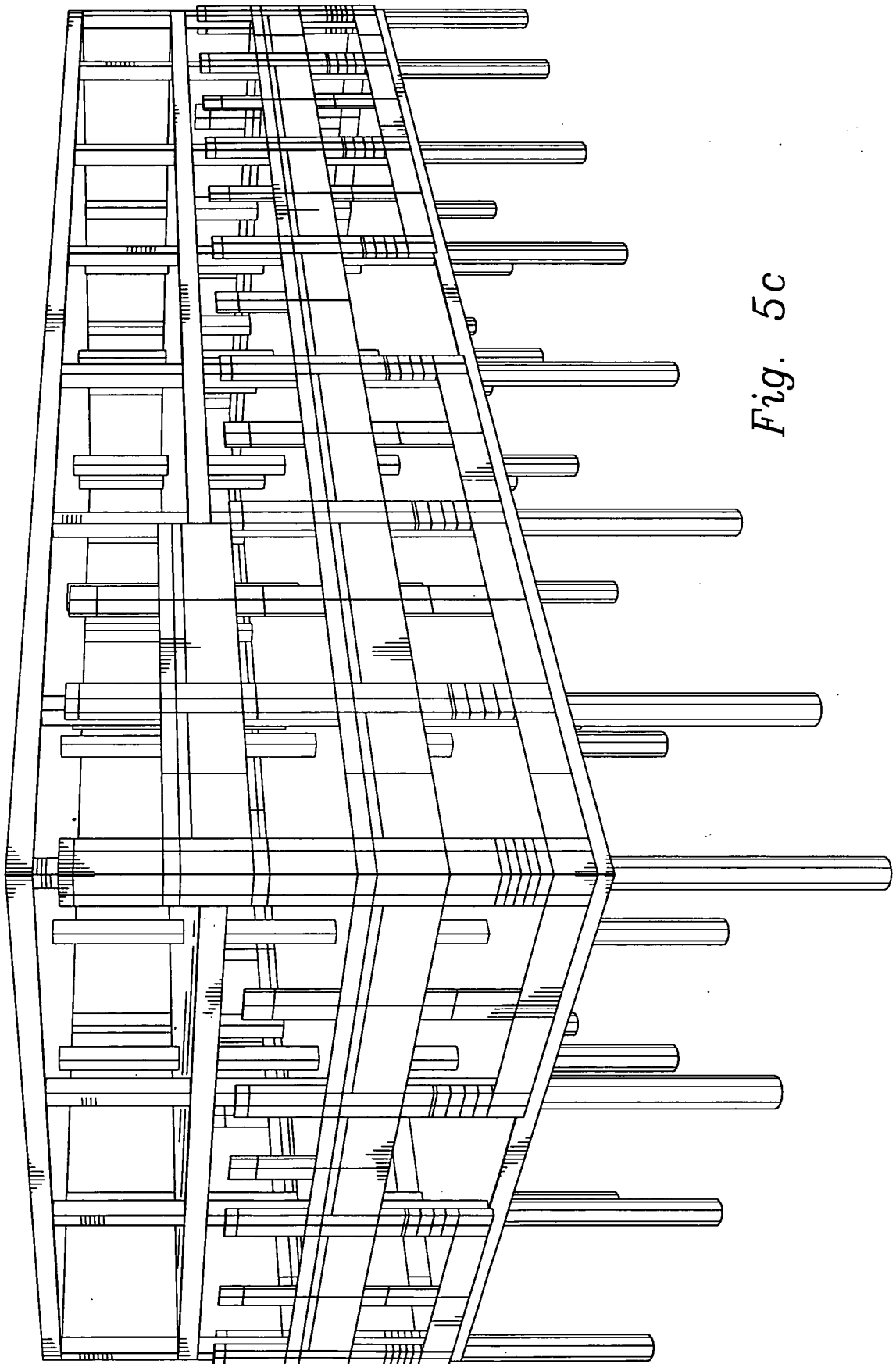


Fig. 5c

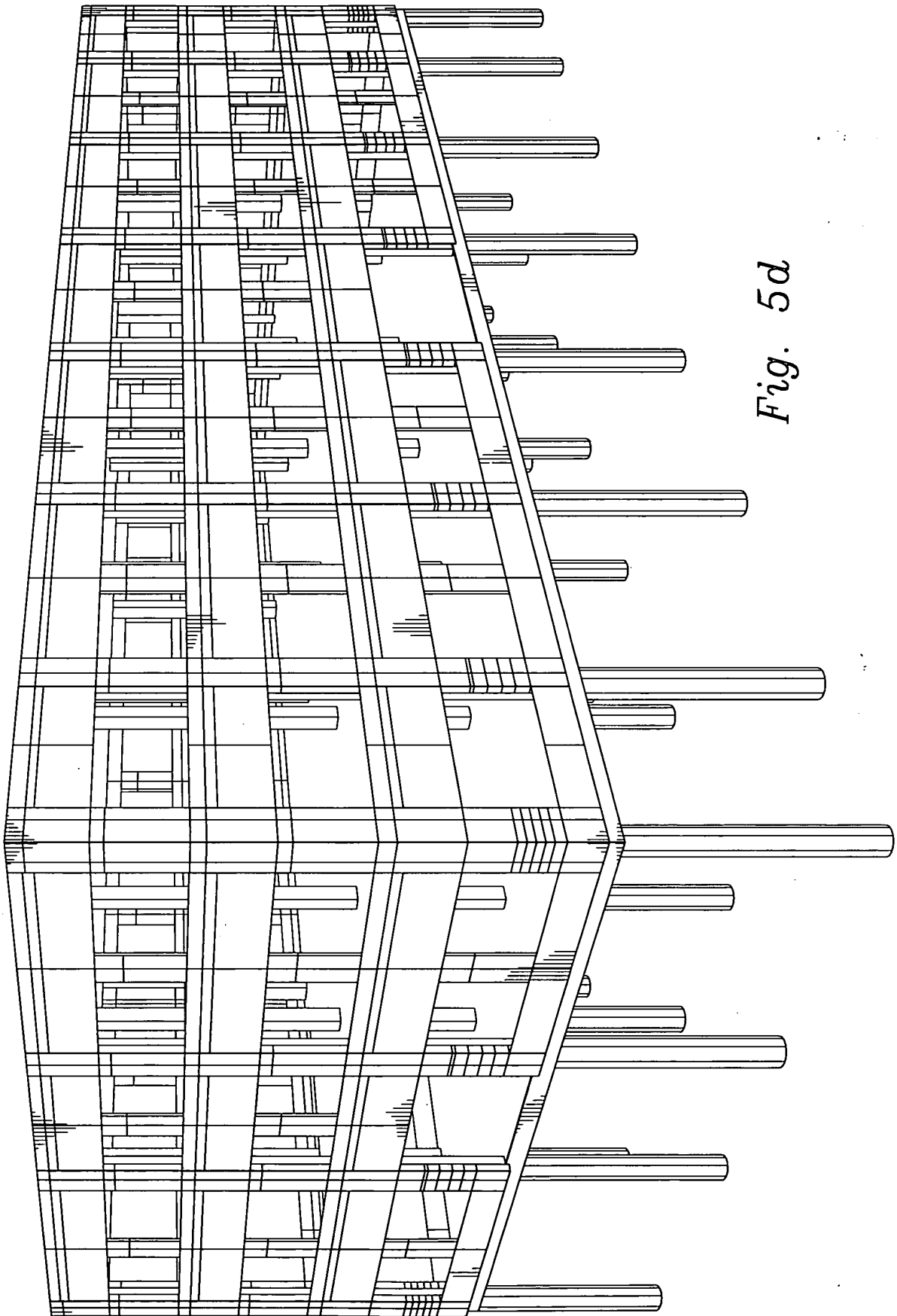


Fig. 5d

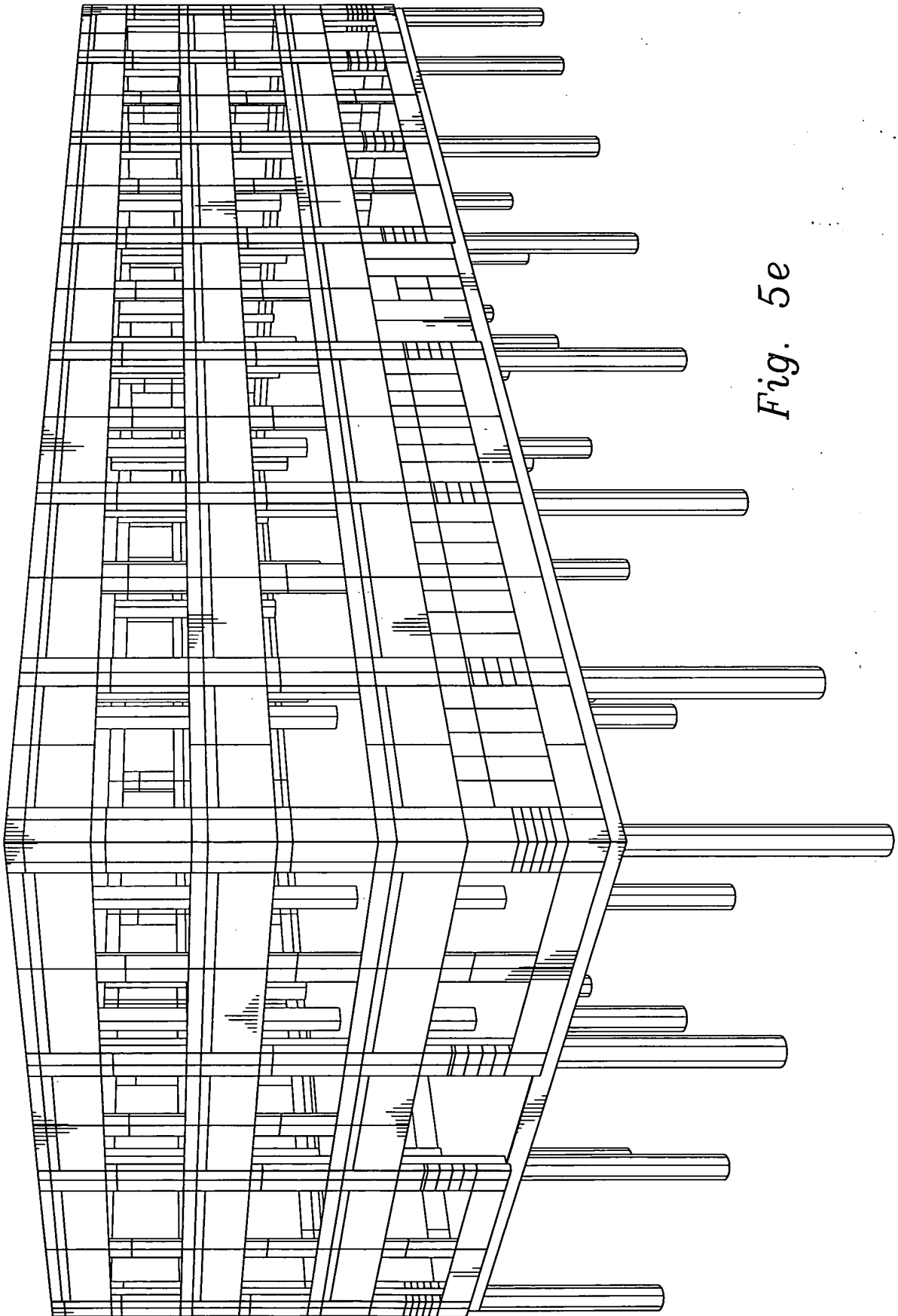


Fig. 5e

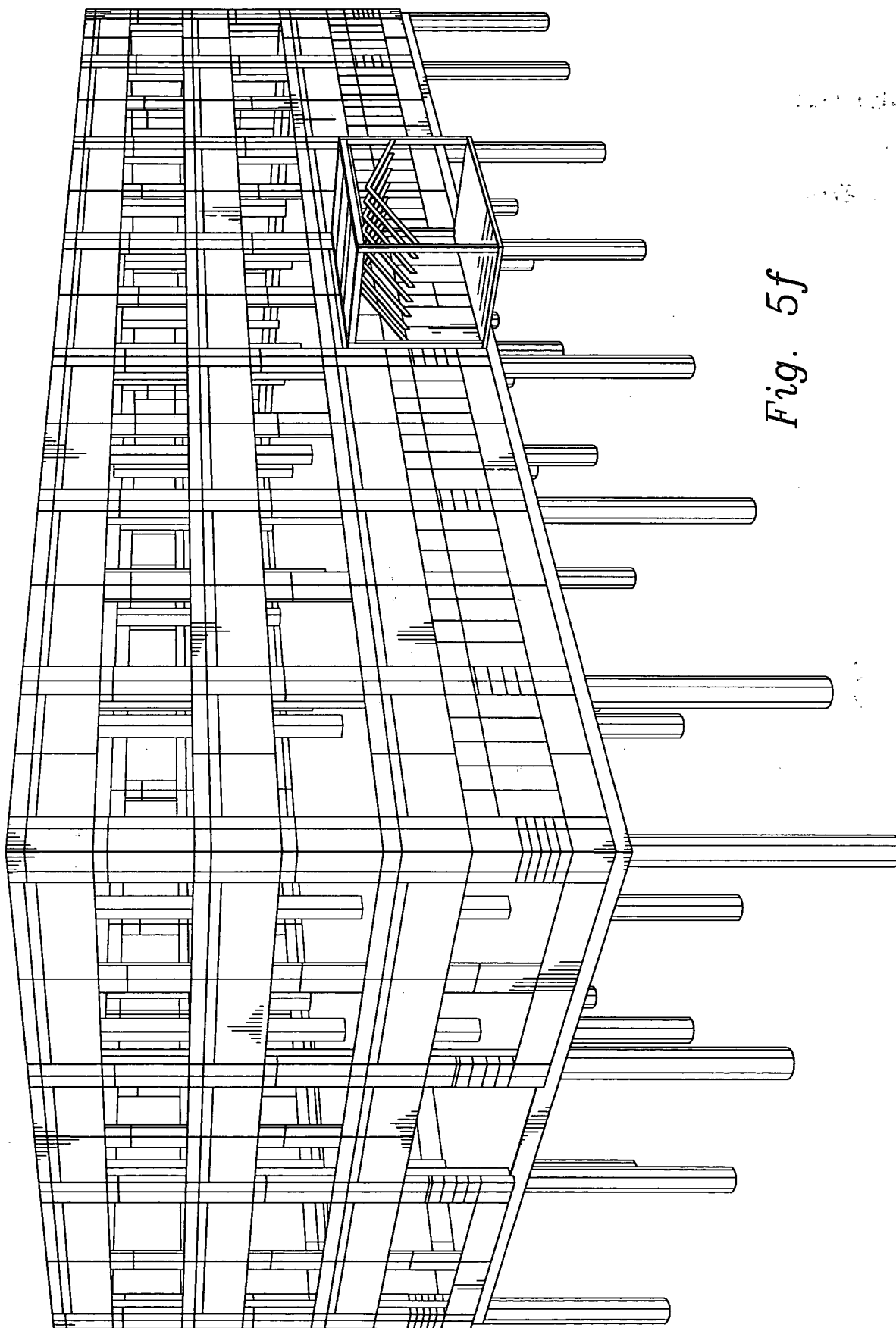


Fig. 5f

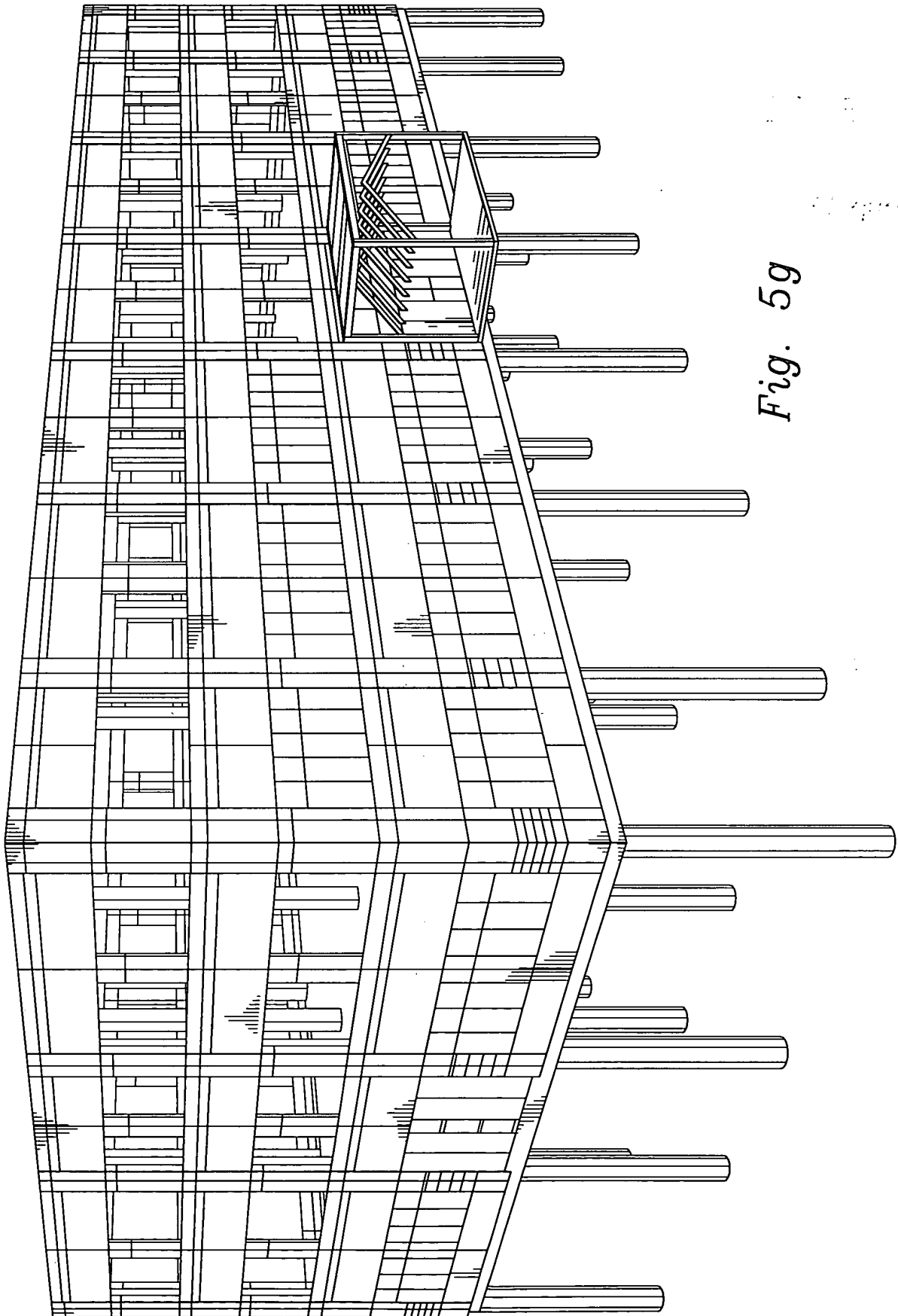


Fig. 5g

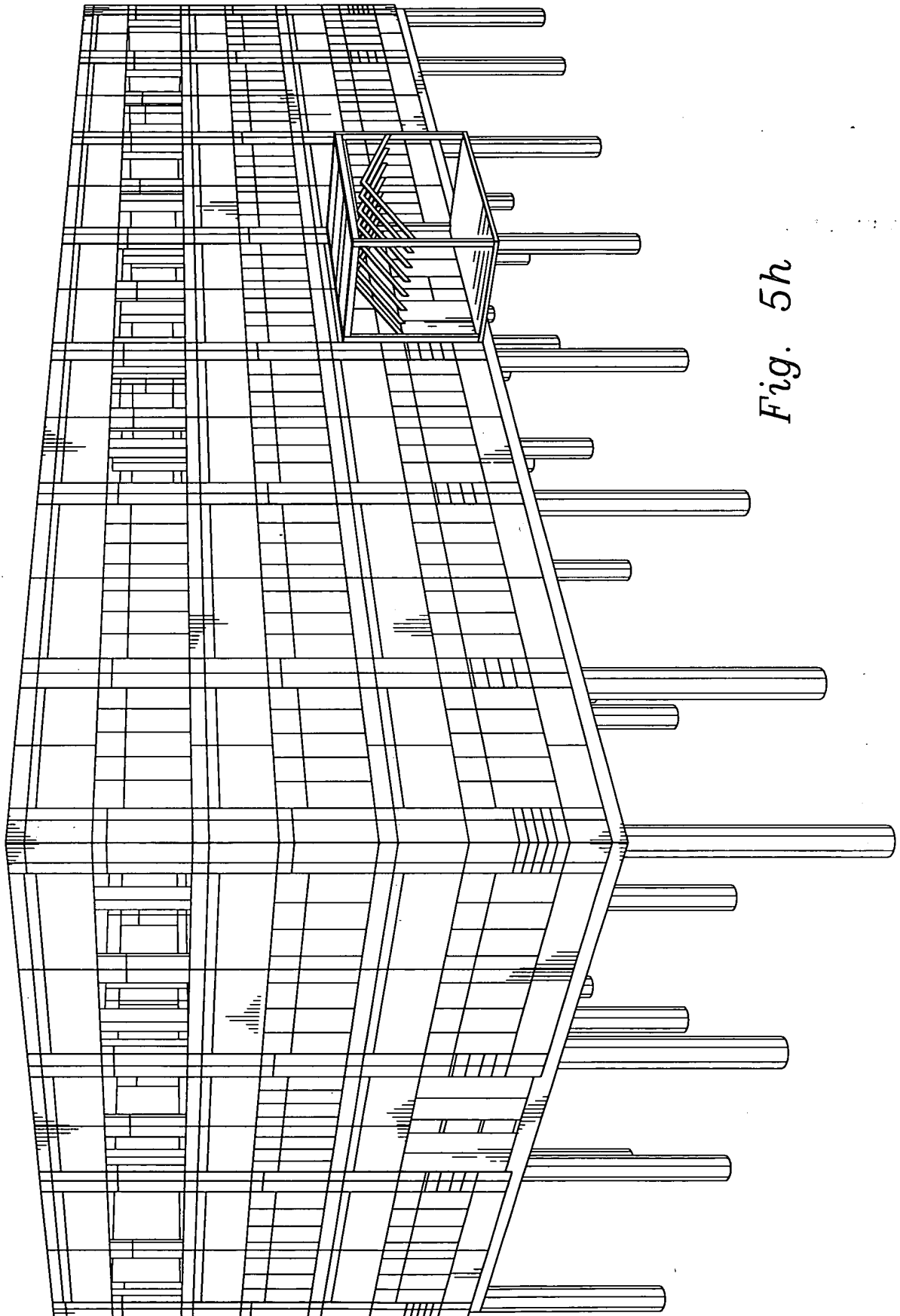


Fig. 5h

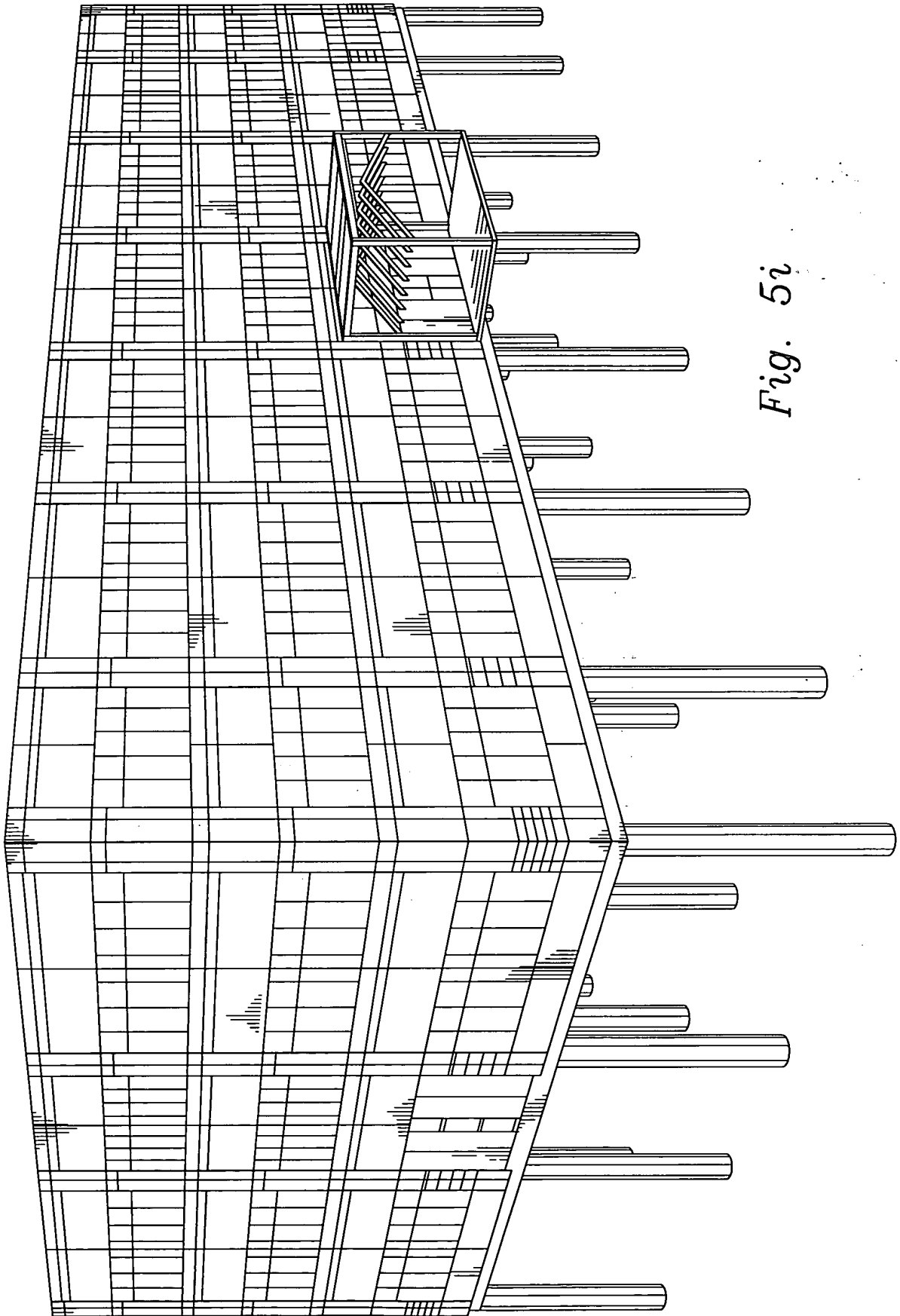
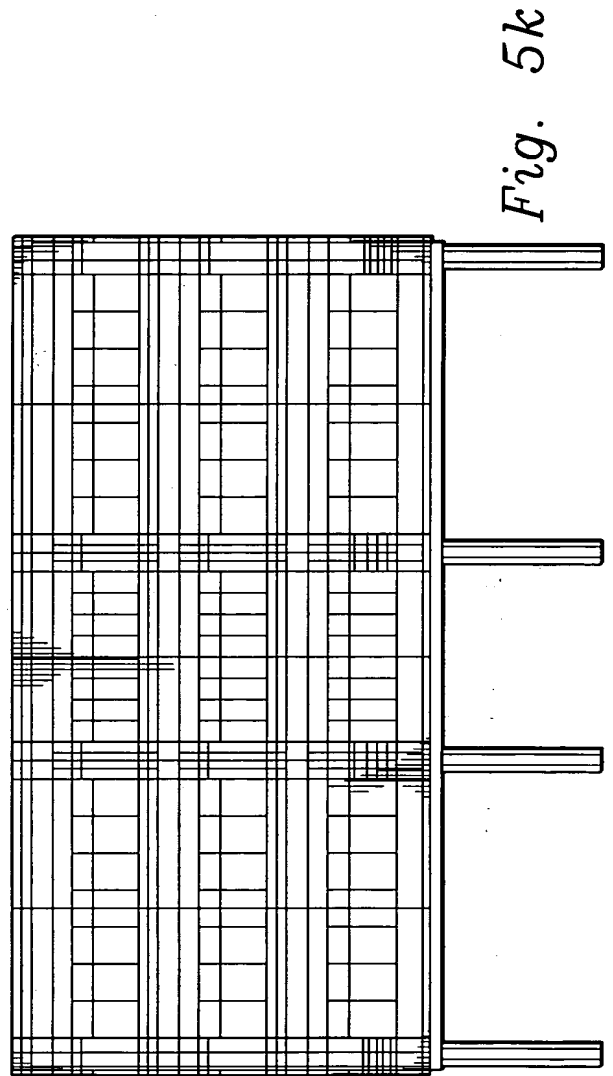
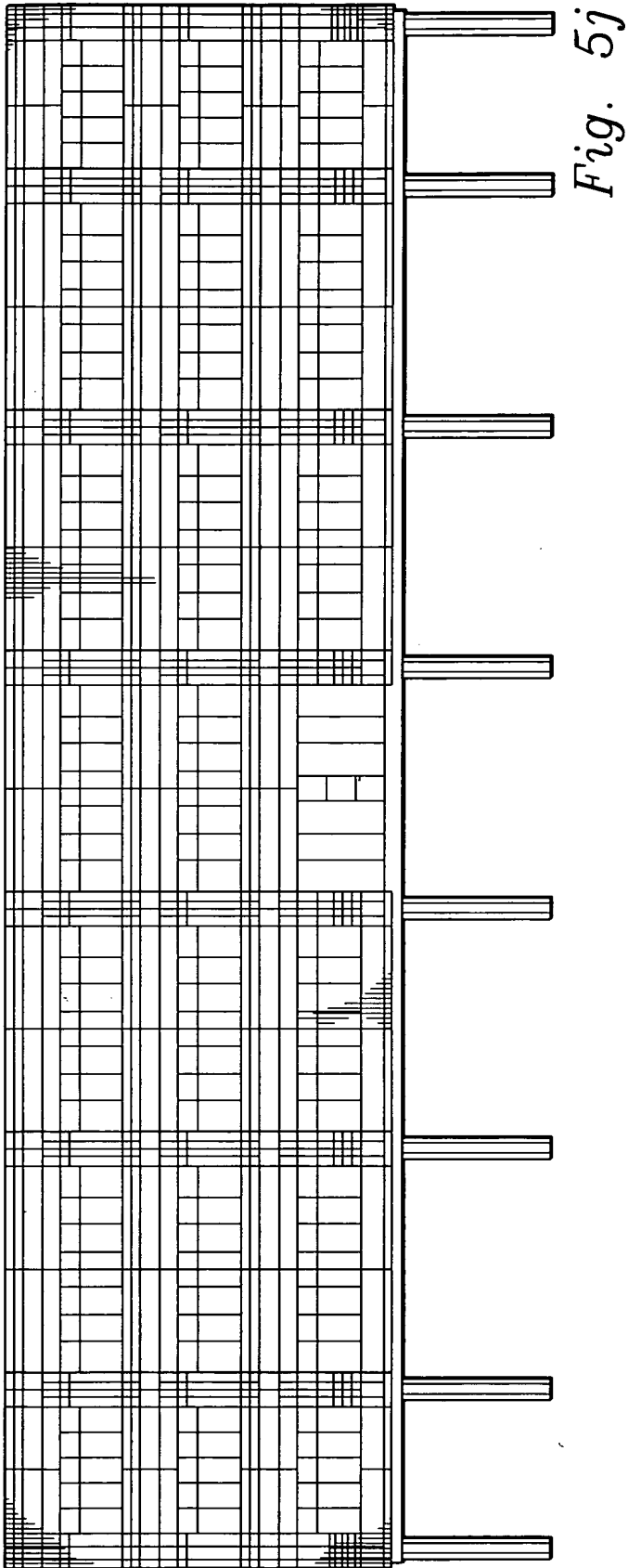


Fig. 5i



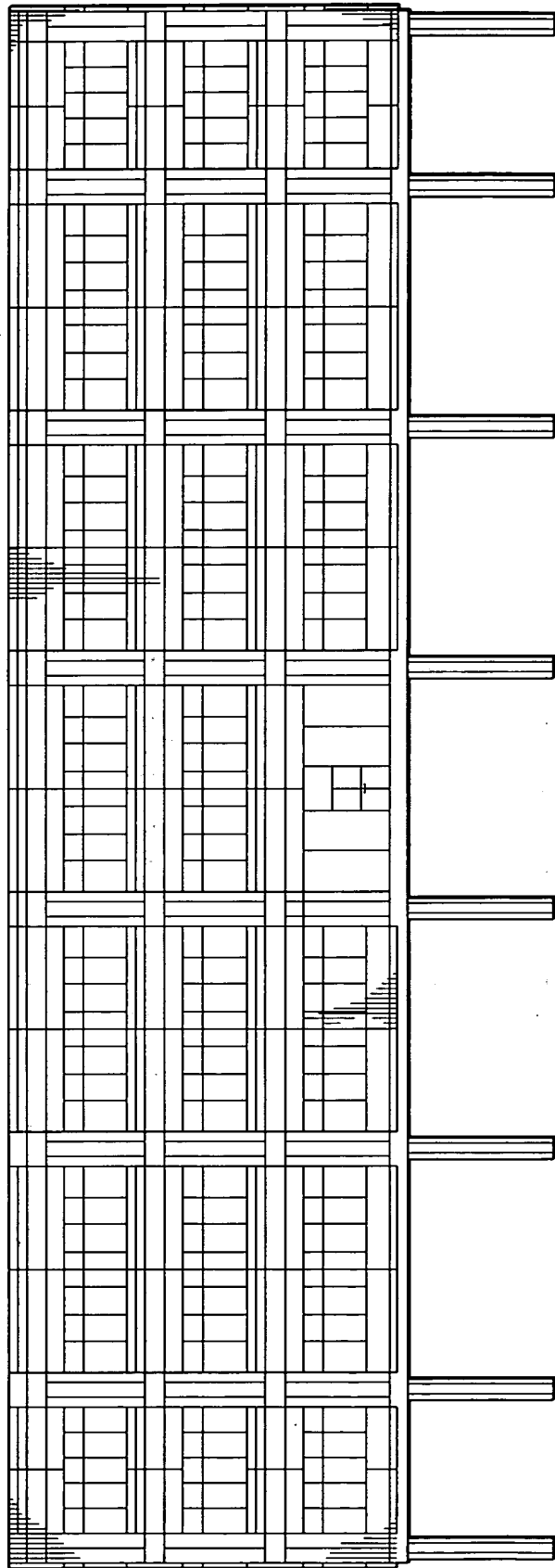


Fig. 5l

